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審査請求　未請求　請求項の数４　ＦＤ　（全７頁）

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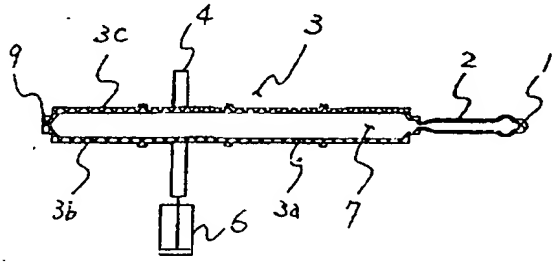
(54)【発明の名称】　中空成形品及びその成形方法

(57)【要約】

【目的】　製品形状の流動入り口側から約７０％（正確には製品の全体積から予想される中空部の体積を差し引いた値）の位置に、開閉可能なシャットオフ弁を設置し、シャットオフ弁を閉じた状態で充填することにより、初期充填の高温域の溶融状態のうちに細部にまで圧力がかかり転写性が良くなり、またジェッティングなどの影響が少なくなるため製品形状が安定する。その後シャットオフ弁を開いて、ガスを注入することによって樹脂が押し広げられ所望の製品形状を得るため、安定した高品質で樹脂を最小限に節減した中空成形品を得ることが出来る。

【構成】　その製品の全体積から予想される中空部の体積を差し引いた体積に相当する流動入り口側からの位置に、開閉可能なシャットオフ弁を設置し、シャットオフ弁まで充填後、シャットオフ弁を開き、ガスの注入によって樹脂が押し広げられることによって所望の製品形状を得る。



【特許請求の範囲】
【請求項１】　その製品の実体積、即ち外表面で占める体積から想定する中空部の容積を差し引いた値に対応する流動入り口側からの位置に、開閉可能なシャットオフ弁を設置した金型を使用した中空射出成形品
【請求項２】　射出時において、当初、シャットオフ弁を閉じた状態で樹脂を充填し、シャットオフ弁を開くとほぼ同時にガスを注入して、まだ溶融している樹脂をシャットオフ弁位置以降の流動端末方向へ押し広げることによって所望の製品形状を得る方法を採用することを特徴とする中空射出成形品
【請求項３】　請求項１の中空成形品を射出成形するための成形方法ならびに中空射出成形用金型。
【請求項４】　請求項２の中空成形品を射出成形するための成形方法ならびに中空射出成形用金型。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、熱可塑性樹脂の中空成形品およびその成形方法に関する。
【０００２】
【従来の技術】従来、中空射出成形においては、広義にショートショット法とフルショット法に大別される。例えば、ショートショット法はキャビティ内に、キャビティ内を満たすより少ない量の溶融樹脂を注入した後、加圧ガスを圧入することによって樹脂を押し広げキャビティ内を満たし、所望の製品形状を得る方法である。また、フルショット法は、キャビティ内を完全に満たす量の溶融樹脂を注入した後、加圧ガスを圧入することによって樹脂をキャビティの外（タブとか捨てキャビと称する部分）に追い出すことで中空部を形成して所望の製品形状を得る方法である。そして、製品の品質レベルおよび経済性を考慮して使い分けていた。
【０００３】
【発明が解決しようとする課題】しかしながら、それぞれ特徴もあるが、次に示すような欠点があった。
（１）　ショートショット法　　キャビティ内に、キャビティ内を満たすより少ない量の溶融樹脂を注入した後、加圧ガスを圧入することによって樹脂を押し広げてキャビティ内を満たし、所望の製品形状を得る方法であり、少ない樹脂量で成形できる利点を持っているが、流動末端が厚肉になってしまう、細かい形状の場合転写し難い、また、多数個どりの場合各キャビティのバランスが悪い等の欠点を有している。
（２）　フルショット法　　キャビティ内を完全に満たす量の溶融樹脂を注入した後、加圧ガスを圧入することによって樹脂をキャビティの外（タブとか捨てキャビと称する部分）に追い出すことで中空部を形成して所望の製品形状を得る方法であり、前記ショートショット法の欠点は補えるものの捨てキャビと称する部分（製品重量の約３０％）を廃棄または再生しなければならない。
以上のように、いずれの方法も大きな欠点があり、どれかを犠牲にするしかなかった。そこで、上記の欠点をいっきに解決する中空射出成形金型および中空射出成形法を提供することを目的とする。
【０００４】
【課題を解決するための手段】製品の全体積から予想される中空部の体積を差し引いた体積に相当する流動入り口側からの位置に、開閉可能なシャットオフ弁を設置し、シャットオフ弁まで充填後、シャットオフ弁を開き、ガスの注入によって樹脂が押し広げられることによって所望の製品形状を得る。
【０００５】
【作用】製品形状の流動入り口側から約７０％（正確には製品の全体積から、予想される中空部の体積を差し引いた値）の位置に、開閉可能なシャットオフ弁を設置し、シャットオフ弁を閉じた状態で充填することにより、初期充填の高温域の溶融状態のうちに細部にまで圧力がかかり転写性が良くなり、またジェッティングなどの影響が少なくなるため製品形状が安定する。その後シャットオフ弁を開いて、ガスを注入することによって樹脂が押し広げられ所望の製品形状を得るため、安定した高品質で樹脂を最小限に節減した中空成形品を得ることが出来る。
【０００６】
【実施例】本発明の実施例を図面に基づいて説明する。図1において、本発明に関する中空成形品の一例を示す。図2から図4は、本発明の構成を示したものであり、図2はキャビティ面の平面図で、シャットオフ弁（４）が閉じられた状態であり、樹脂の充填を終了したところを示す。図3は図2と同じ状態で横から見た図である。図4は図2のＡ－Ａ断面を示し、シリンダー（６）にて稼動側シャットオフ弁（４ａ）と固定側シャットオフ弁（４ｂ）を連結して流路（５）を開閉する。すなわち、シャットオフ弁（４（4a，４ｂ））が閉じられた状態で、溶融樹脂がスプルー（１）からランナー（２）を伝わりキャビティ（３ａ）に充填される。この状態は、前記したフルショット法と同じ効果がもたらされ、この時キャビティ（３ａ）内の溶融樹脂（３）には内圧がかかる（ショートショット法の場合は溶融樹脂が完全に満たされてないためさほど内圧がかからない）ため細かい形状のリブ（８）にも確実に転写される。
【０００７】その後、図5で示すようにスプルー（１）から高圧ガス（７）を注入（高圧ガスはランナーまたはキャビティから注入してもよい）し、同時あるいは若干遅らせてシャットオフ弁（４）をシリンダー（６）等により開く。シャットオフ弁（４）が開くことによって高圧ガス（７）によりキャビティ（３ａ）の樹脂（３）がシャットオフ弁（４）から前方に押し出され、中空部（７）を形成し、高圧ガス（７）の圧力による保圧効果

によって所望の製品形状（３ｃ）が得られる。おわりに、所定のガス保持時間経過後、製品形状（３ｃ）を取り出す。この時シャットオフ弁（４）は開放されているため製品突き出しが可能であり、製品取り出し後充填開始までにシャットオフ弁（４）を閉める。

【０００８】また、図6に示される実施例では、流動末端部にごく小さな捨てキャビ（１０）を設けている。捨てキャビ（１０）を設けることにより、ガス（７）を製品の外部まで貫通させて流動末端の厚肉部（９）を避けた例である。

【０００９】つぎに、図7から図9に樹脂充填からガス保圧終了までの一連のフローの状態を示す．図7は樹脂充填時、図8はガス注入開始時を示し、図9はガス注入完了時を示す。

【００１０】最後に、本発明によらない一般の中空成形について、本発明との比較をしながら説明する。図１０から図１３は、ショートショット法を示したものであり、図１０は樹脂充填時、図１１はガス注入開始時、図１２はガス注入完了時示す。この時図１０に示す樹脂充填時には、キャビティ内には、空間が残っており内圧があまりかからないため、図１３に示す細かい形状のリブ（８）部にはショート部（１１）が発生し、表面が固化をはじめてしまうため、ガスを注入してもショート部（１１）が残ってしまう。図１４から図１５は、フルショット法を示したものであり、図１４は樹脂充填時、図１５はガス注入完了を時示す。　この時、図示はしていないが捨てキャビ入り口部にシャットオフ弁を設置することが多い。以上説明した従来のショット法、および金型構造に対し、本発明のショット法、および金型構造は、前述したように製品内にシャットオフ弁（４）を設置している。

【００１１】

【発明の効果】本発明は、以上説明したように構成されているので、以下に記載されるような効果を奏する。

（１）　シャットオフ弁を製品内に設置するので、樹脂量はシャットオフ弁までの量があればよく少ない樹脂量でよい。

（２）　完全充填してからガスを注入するため、キャビティ内にある程度内圧がかかるため転写性が良く微細な形状も可能である。

（３）　ショートショット法と同程度の樹脂量でフルショット法と同じようにフル充填できるので高精度で、しかも経済性によい。

以上のように、フルショット法でありながら、フルショット法の利点である高転写性、高安定性を確保しながら、ショートショット法と同様にキャビティ内体積（製品形状）より少ない樹脂量で成形が可能であり、安定した製品を効率よく廉価に得ることが出来る。

【００１２】

【図面の簡単な説明】

【図１】本発明に関する中空成形品の一例

【図２】キャビティ面の平面図

【図３】キャビティ面の側面図

【図４】

【図２】のＡ－Ａ断面図

【図５】ガス注入完了時のキャビティ面の平面図

【図６】流動末端部にごく小さな捨てキャビを設けた実施例の平面図

【図７】本発明における樹脂充填時の平面図

【図８】本発明におけるガス注入時の平面図

【図９】本発明におけるガス注入完了時の平面図

【図１０】本発明によらないショートショット法での樹脂充填時の平面図

【図１１】本発明によらないショートショット法でのガス注入時の平面図

【図１２】本発明によらないショートショット法でのガス注入完了時の平面図

【図１３】本発明によらないショートショット法で成形したときの細かい形状のリブ部の拡大図

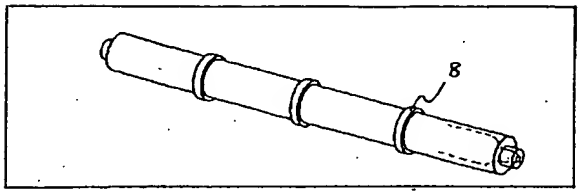
【図１４】本発明によらないフルショット法での樹脂充填時の平面図

【図１５】本発明によらないフルショット法でのガス注入完了時の平面図

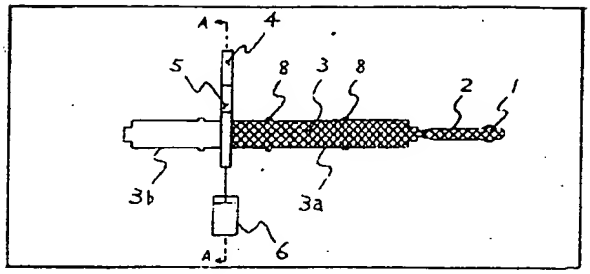
【符号の説明】

１　スプルー
２　ランナー
３　溶融樹脂
３ａ　キャビティ
３ｂ　キャビティ
３ｃ　製品形状
４　シャットオフ弁
４ａ　シャットオフ弁（可動側）
４ｂ　シャットオフ弁（固定側）
５　流路
６　シリンダー
７　高圧ガス
８　細かい形状のリブ
９　厚肉部
１０　捨てキャビ
１１　ショート部

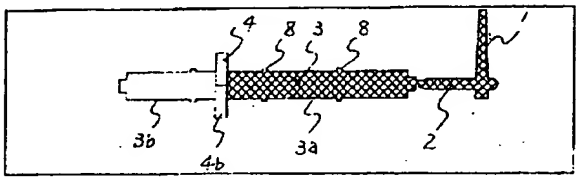
【図1】



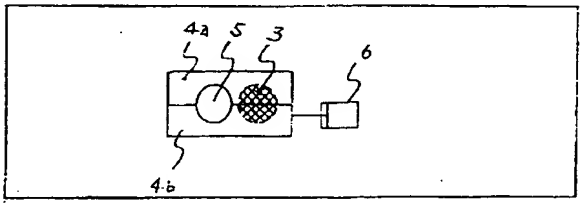
【図2】



【図3】



【図4】



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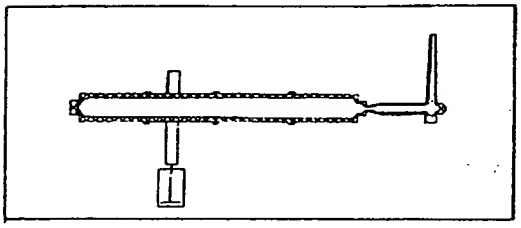
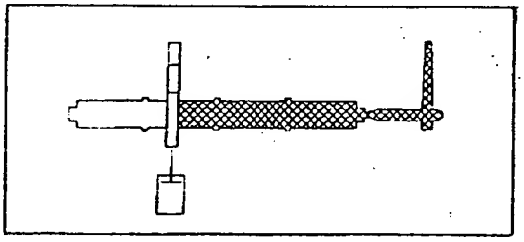
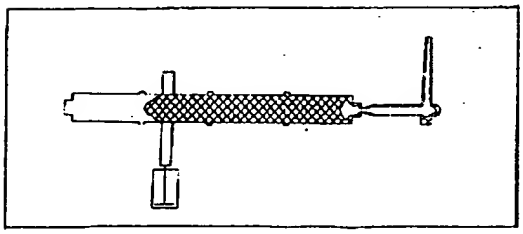


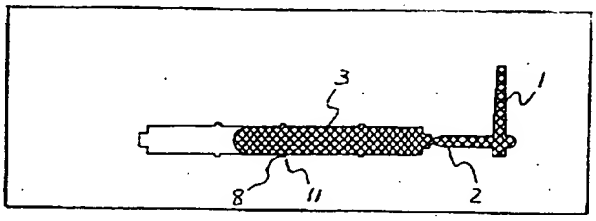
【図8】



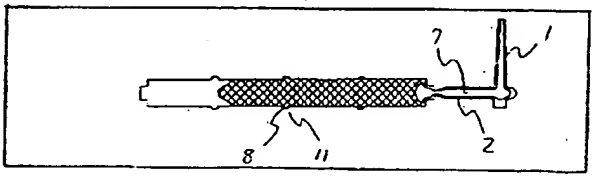
【図9】



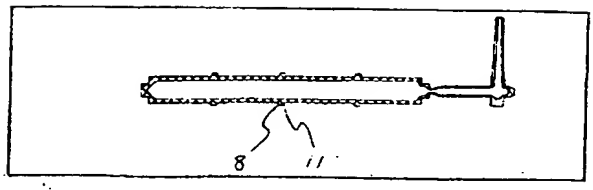
【図10】



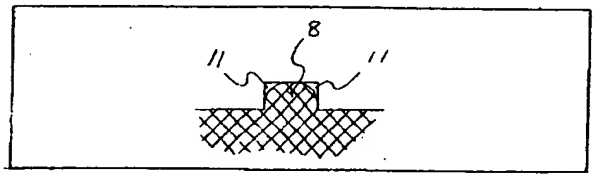
【図11】



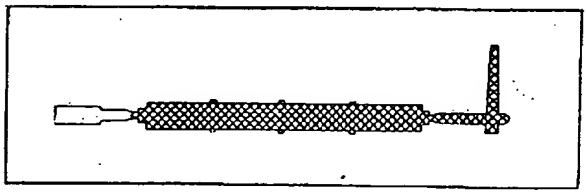
【図12】



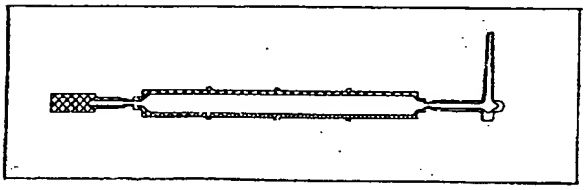
【図13】



【図14】



【図15】



【手続補正書】
【提出日】平成9年7月7日
【手続補正1】
【補正対象書類名】明細書
【補正対象項目名】図面の簡単な説明
【補正方法】変更
【補正内容】
【図面の簡単な説明】
【図1】本発明に関する中空成形品の一例
【図2】キャビティ面の平面図
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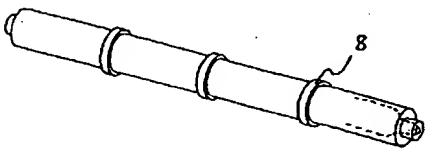
【図4】
【図2】のA－A断面図
【図5】ガス注入完了時のキャビティ面の平面図
【図6】流動末端部にごく小さな捨てキャビを設けた実施例の平面図
【図7】本発明における樹脂充填時の平面図
【図8】本発明におけるガス注入時の平面図
【図9】本発明におけるガス注入完了時の平面図
【図10】本発明によらないショートショット法での樹脂充填時の平面図

【図１１】本発明によらないショートショット法でのガス注入時の平面図
【図１２】本発明によらないショートショット法でのガス注入完了時の平面図
【図１３】本発明によらないショートショット法で成形したときの細かい形状のリブ部の拡大図
【図１４】本発明によらないフルショット法での樹脂充填時の平面図
【図１５】本発明によらないフルショット法でのガス注入完了時の平面図
【符号の説明】
１　スプルー
２　ランナー
３　溶融樹脂
３ａ　キャビティ
３ｂ　キャビティ
３ｃ　製品形状
４　シャットオフ弁
４ａ　シャットオフ弁（可動側）
４ｂ　シャットオフ弁（固定側）
５　流路
６　シリンダー
７　高圧ガス
８　細かい形状のリブ
９　厚肉部
１０　捨てキャビ
１１　ショート部
【手続補正２】
【補正対象書類名】図面
【補正対象項目名】全図
【補正方法】変更
【補正内容】

【図１】



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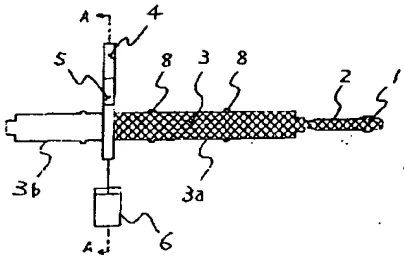

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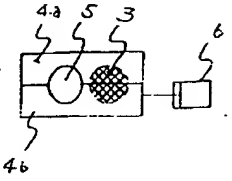

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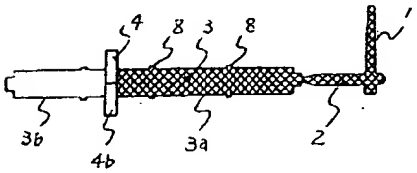

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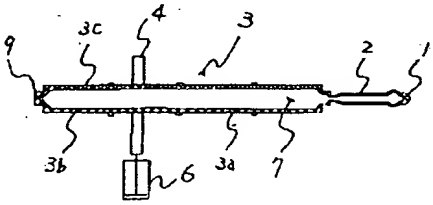

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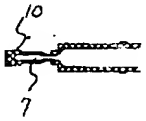

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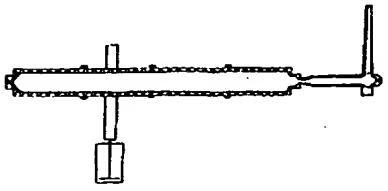

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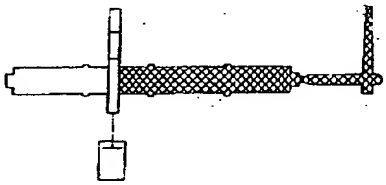

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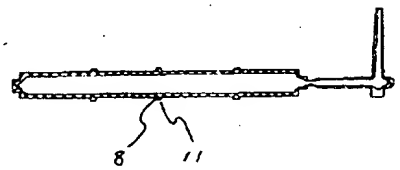

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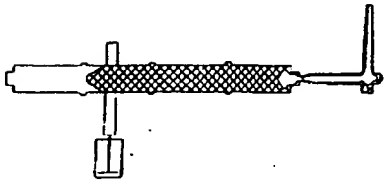

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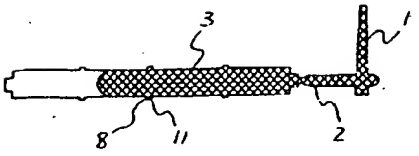

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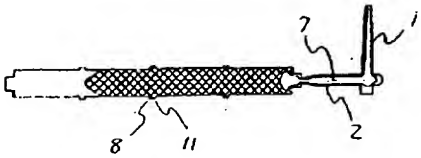

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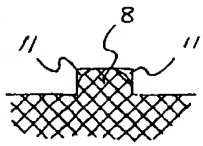

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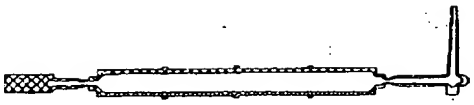

EUROPEAN PATENT OFFICE

Patent Abstracts of Japan

PUBLICATION NUMBER : 10291227
PUBLICATION DATE : 04-11-98

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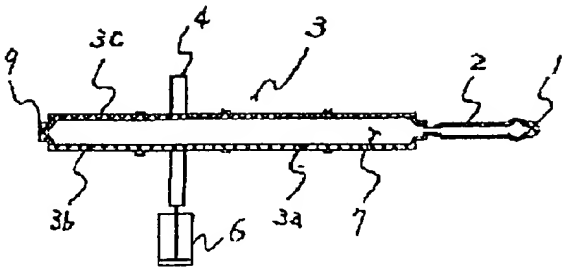
APPLICATION NUMBER : 09116323

APPLICANT : MUSASHI KAKO KK;

INVENTOR : SAITO KAZUO;

INT.CL. : B29C 45/00 // B29L 22:00

TITLE : BLOW MOLDING AND ITS FORMING METHOD



ABSTRACT : PROBLEM TO BE SOLVED: To reduce a necessary resin amount and to upgrade transferability by using a mold having a shut-off valve installed at a position froth a flow inlet side corresponding to a volume obtained by subtracting a predicted volume of a hollow part from an overall volume of a product.

SOLUTION: A switching shut-off valve 4 is installed at a position of a value obtained by subtracting a predicted volume of a hollow part from an overall volume of a product, and melted resin 3 is charged in a cavity 3a via a sprue 1 and a runner 2 in the state that the valve 4 is closed. In this state, since an internal pressure is applied to the resin 3 in the cavity 3a, it is effectively transferred to a part of a fine shape. Thereafter, high pressure gas 7 is introduced from the sprue 1, and the valve 4 is opened by a cylinder 6 simultaneously or by slightly delaying. As a result, the resin 3 of the cavity 3a is urged out forward from the valve 4 to form a hollow part 7. Thus, a desired product shape 3c is obtained by a dwelling effect due to the pressure of the gas 7.

(11) Laid-open No. 10-291227
(43) Laid-open date: November 4, 1998
(21) Application No. 9-116323
(22) April 18, 1997
(71) Applicant: Musashi Kako Inc.
(54) [TITLE OF THE INVENTION]
Hollow Molded Part and Manufacturing Method of the Same
[SCOPE OF CLAIMS FOR PATENT]
[CLAIM 1] A hollow molded part produced by a mold where an on-off shutoff valve is located in position a certain distance ahead of an entrance of the fluidized material to partition a mold cavity so that a proximal cavity segment keeps a volume obtained by subtracting an estimated volume of a center hollow portion of the molded product from a total net volume of an outer shell of the molded product.
[CLAIM 2] A hollow molded part obtained by a molding method where, during injection molding, a mold cavity is initially filled with resin while a shutoff valve keeps closed, and then, gas is injected in the cavity almost simultaneous with opening the shutoff valve to spread the resin still in molten phase to a distal end of the cavity beyond the shutoff valve so as to obtain the molded part of the desired shape.
[CLAIM 3] An injection molding method and a mold used for blow injection molding to fabricate the hollow molded part as defined in claim 1.
[CLAIM 4] An injection molding method and a mold used for blow injection molding to fabricate the hollow molded part as defined in claim 2.
[DESCRIPTION OF THE INVENTION]
[0001]
[FIELD OF THE INVENTION]
The present invention relates to a hollow molded part of thermoplastic resin and a manufacturing method of the same.
[PRIOR ART]
[0002]
Typically in the art, blow injection molding is broadly classified in the short shot method and the full shot method. For instance, the short shot method includes procedures of injecting molten resin to fill a mold cavity with the resin of an amount less than the full volume of the cavity, and then sending compressed gas in the cavity to spread the resin around the cavity in

order to transfer the desired mold shape. In contrast, the full shot method is a molding method where after resin as much as the full volume of the cavity is injected in the cavity, compressed gas is supplied to thrust part of the resin out of the cavity to the external space (i.e., portions named 'tub' or 'waste cavity') so as to obtain a mold part of the desired shape with its center portion left hollow. Thus, both the shot methods are selectively exploited, allowing for a quality level of the mold product and the manufacturing economics.

[0 0 0 3]

[DISADVANTAGED OF THE PRIOR ART]

These shot methods, however, have respectively been found to have some disadvantages as mentioned below.

(1) In the short shot method where, in order to obtain a molded product of the desired shape, the mold cavity is first filled with molten resin of an amount less than the full volume of the cavity and then supplied with compressed gas to spread the molten resin around the cavity, there is an advantage that the molded product can be obtained with a reduced amount of resin, but there also arise various disadvantages that the distal end of the fluidized material is left thickened, that very fine contours of the mold are hard to transfer, that mass production leads to molded pieces which are not uniform as a result of uneven transfer of the cavity shape, and so forth.

(2) In the full shot method where, in order to obtain a molded product of the desired shape, the mold cavity is first filled with molten resin of an amount as much as the full volume of the cavity and then supplied with compressed gas to thrust part of the molten resin out of the cavity to the 'tub' or the 'waste cavity' to leave the center portion hollow, the above disadvantages of the short shot method can be compensated, but there still is a disadvantage that the portion shaped by the waste cavity (30% of the total weight of the molded product) should be discarded or reused.

As has been described, either of the methods is considerably disadvantageous, and some of their advantages exist by virtue of sacrifices of other advantages. Accordingly, it is an object of the present invention to provide a mold for blow injection molding and a method of the same.

[0 0 0 4]

[SOLUTIONS]

An on-off shutoff valve located in a mold is in position a certain distance ahead of a fluidized material entrance to partition a mold cavity so that a

proximal cavity segment keeps a volume obtained by subtracting an estimated volume of a center hollow portion of the molded product from its total volume, and after the cavity segment defined by the shutoff valve is filled with molten resin, gas is injected to spread the resin around the cavity to obtain the molded product of the desired shape.

[0005]

[IMPROVED FEATURES]

An on-off shutoff valve is located in position to partition about 70% of the product volume off the mold cavity to define a cavity segment directly leading from an entrance of the fluidized material (precisely, the volume of the cavity segment is obtained by subtracting an estimated volume of a center hollow portion of the product from its total volume), and while the shutoff valve keeps closed, the cavity segment is filled with molten resin. Thus, pressure distributed over the high temperature molten resin in the initial stage of the filling is applied even to corners of minute part of the mold, and this enhances transferability of the mold contours with reduced influence of jetting, which useful to stabilize the grade of the molded product. After that, opening the shutoff valve and injecting gas permit the resin to spread around the cavity to give the desired shape to the product, and in this manner, hollow molded pieces of a stable high grade can be produced, saving the material resin due to the minimal use of it.

[0006]

[EMBODIMENTS]

Embodiments of the present invention will be described in conjunction with the accompanying drawings. Fig. 1 depicts an exemplary hollow molded part according to the present invention. Figs. 2 to 4 illustrate configurations according to the present invention; Fig. 2 is a top plan view of a mold cavity with a shutoff valve 4 being closed, showing the filling of resin being completed, Fig. 3 is a side view of Fig. 2, and Fig. 4 is a sectional view taken along the line A-A in Fig. 2. A cylinder 6 connects a movable shutoff valve 4a with a fixed shutoff valve 4b to open and close a fluid path 5. While the shutoff valve 4 (4a and 4b) is closed, molten resin is transferred through a sprue 1 into a runner 2 to fill a cavity 3a with the resin. This results in the same effect as brought about by the aforementioned full shot method, and under the circumstances, the internal pressure is applied to the molten resin 3 in the cavity 3a (although an incomplete filling of the cavity by the short

shot method does not cause so much internal pressure to be applied to the molten resin), which enables the molten resin to spread out into very narrow gauge ribs 8 to ensure a fine transfer.

[0007]

After that, as illustrated in Fig. 5, compressed gas 7 injected through the sprue 1 is directed at the resin (alternatively, the compressed gas may be injected through the runner or from the cavity), and simultaneous with this, or slightly after, the cylinder 6 or other means is used to open the shutoff valve 4. With the shutoff valve 4 being opened, the compressed gas 7 thrusts part of the resin 3 out of the cavity 3a ahead of the shutoff valve 4 to leave center part 7 hollow, and the dwell pressure derived from the compressed gas 7 brings about a molded part 3c of the desired shape. Eventually, after a certain period to keep the dwell condition, the molded part 3c is taken. During this procedure, as the shutoff valve 4 is left open, the molded part can be pushed forward, and after the molded part is removed from the mold, the shutoff valve 4 is closed no later than the succeeding mold filling is carried out.

[0008]

Also, in an embodiment shown in Fig. 6, a considerably small waste cavity 10 is defined in a tip of the fluid path. The waste cavity 10 permits the gas 7 to pass beyond the extreme distal end of the mold to avoid leaving a thickened portion 9 at the distal end of the fluidized material.

[0009]

Figs. 7 to 9 illustrate a series of process steps from the filling with resin till the end of the post-treatment under the dwell condition. Especially, Fig. 7 depicts the filling with resin, Fig. 8 shows the beginning of gas injection, and Fig. 9 illustrates the completed gas injection.

[0010]

Finally, a well-known blow molding according to a general method other than the present invention will now be described in comparison with the present invention. Figs. 10 to 13 illustrate the short shot method; Fig. 10 depicts the filling with resin, Fig. 11 shows the beginning of gas injection, and Fig. 12 illustrate completion of gas injection. The cavity, while being filled with resin as shown in Fig. 10, still has some part left unfilled and gets rid of so much internal pressure, and this resultantly leaves some part 11 of the very narrow gauge ribs 8 in short supply with the resin. Since the resin has

its outer surface cured first, the subsequent gas injection could not do any longer with the short supply at that part 11. Figs. 14 and 15 illustrate the full shot method; especially, Fig. 14 depicts the filling with resin while Fig. 15 shows completion of gas injection. In these situations, a shutoff valve is, although not shown, often located at an entrance of the waste cavity. In contrast with the shot method and the mold configuration described so far in relation with the prior art embodiment, the shutoff valve 4 used in terms of the shot method and the mold configuration according to the present invention is located in the midst of the mold cavity.

[0011]

[EFFECTS OF THE INVENTION]

Configured as mentioned above, the present invention attains effects as listed below.

(1) Since the shutoff valve is located in the midst of the mold cavity, an amount of resin may be reduced to as much as sufficient to fill part of the mold cavity sectioned by the shutoff valve.

(2) Since gas is injected after completely filling the cavity with resin, a certain degree of the internal pressure within the cavity permit improved transferability of very fine contours of the mold.

(3) Since resin almost as much as used in the short shot method is sufficient to fully fill the sectioned mold cavity as in the full shot method, the precision-enhanced and cost-effective molding can be attained.

As has been described, the present invention implements hybrid molding of the full shot and short shot methods in which an amount of resin less than the volume of a mold cavity space (complete cavity volume) is sufficient as in the ordinary short shot method although benefits of precise transferability and high molding stability are still ensured as in the full shot method, so that molded products of stable grade can be efficiently obtained at a reduced cost.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[FIGURE 1] A diagram showing a hollow molded part of the present invention.

[FIGURE 2] A top plan view of a mold cavity.

[FIGURE 3] A side view of the cavity.

[FIGURE 4] A sectional view along the line A-A of Fig. 2.

[FIGURE 5] A top plan view of the cavity upon completion of gas injection.

[FIGURE 6] A plan view illustrating an embodiment where a considerably

small waste cavity is provided at a distal end of a fluid path.

[FIGURE 7] A top plan view of the invention upon the filling with resin.

[FIGURE 8] A top plan view of the invention upon gas injection.

[FIGURE 9] A top plan view of the invention upon completion of gas injection.

[FIGURE 10] A top plan view of the well-known example other than the present invention upon the filling with resin in the short shot method.

[FIGURE 11] A top plan view of the well-known example other than the present invention upon gas injection in the shot method.

[FIGURE 12] A top plan view of the well-known example other than the present invention upon completion of gas injection in the short shot method.

[FIGURE 13] An enlarged view showing one of very narrow gauge ribs in the course of the prior art molding in the short shot method.

[FIGURE 14] A top plan view of the well-known example other than the present invention upon the filling with resin in the short shot method.

[FIGURE 15] A top plan view of the well-known example other than the present invention upon completion of gas injection in the full shot method.

[DESCRIPTIONS OF REFERENCE ALPHANUMERIC SYMBOLS]

1	Sprue
2	Runner
3	Molten Resin
3a	Cavity
3b	Cavity
3c	Molded Part
4	Shutoff valve
4a	Movable Shutoff valve
4b	Fixed Shutoff valve
5	Fluid Path
6	Cylinder
7	Compressed Gas
8	Very Narrow Gauge Ribs
9	Thickened Portion
10	Waste Cavity
11	Part in Short Supply

(57) [ABSTRACT]

[OBJECT OF THE INVENTION]

An on-off shutoff valve is located in position to partition about 70% of the product volume off the mold cavity to define a cavity segment directly leading from an entrance of the fluidized material (precisely, the volume of the cavity segment is obtained by subtracting an estimated volume of a center hollow portion of the product from its total volume), and while the shutoff valve keeps closed, the cavity segment is filled with molten resin. Thus, pressure distributed over the high temperature molten resin in the initial stage of the filling is applied even to corners of minute part of the mold, and this enhances transferability of the mold contours with reduced influence of jetting, which useful to stabilize the grade of the molded product. After that, opening the shutoff valve and injecting gas permit the resin to spread around the cavity to give the desired shape to the product, and in this manner, hollow molded pieces of a stable high grade can be produced, saving the material resin due to the minimal use of it.

[SOLUTION]

An on-off shutoff valve located in a mold is in position a certain distance ahead of a fluidized material entrance to partition a mold cavity so that a proximal cavity segment keeps a volume obtained by subtracting an estimated volume of the center hollow portion from a total volume of the molded product, and after the cavity segment defined by the shutoff valve is filled with molten resin, gas is injected to spread the resin around the cavity to obtain the molded product of the desired shape.

[AMENDMENT]
[DATE OF SUBMISSION] July 7, 1997
[AMENDMENT 1]
[AMENDED DOCUMENT] Specification
[AMENDED ARTICLE] Brief Description of the Drawings
[TYPE OF AMENDMENT] Revision
[AMENDED MATTERS]

[BRIEF DESCRIPTION OF THE DRAWINGS]

[FIGURE 1] A diagram showing a hollow molded part of the present invention.

[FIGURE 2] A top plan view of a mold cavity.

[FIGURE 3] A side view of the cavity.

[FIGURE 4] A sectional view along the line A-A of Fig. 2.

[FIGURE 5] A top plan view of the cavity upon completion of gas injection.

[FIGURE 6] A plan view illustrating an embodiment where a considerably small waste cavity is provided at a distal end of a fluid path.

[FIGURE 7] A top plan view of the invention upon the filling with resin.

[FIGURE 8] A top plan view of the invention upon gas injection.

[FIGURE 9] A top plan view of the invention upon completion of gas injection.

[FIGURE 10] A top plan view of the well-known example other than the present invention upon the filling with resin in the short shot method.

[FIGURE 11] A top plan view of the well-known example other than the present invention upon gas injection in the shot method.

[FIGURE 12] A top plan view of the well-known example other than the present invention upon completion of gas injection in the short shot method.

[FIGURE 13] An enlarged view showing one of very narrow gauge ribs in the course of the prior art molding in the short shot method.

[FIGURE 14] A top plan view of the well-known example other than the present invention upon the filling with resin in the short shot method.

[FIGURE 15] A top plan view of the well-known example other than the present invention upon completion of gas injection in the full shot method.

【AMENDMENT 2】
【AMENDED DOCUMENT】 Drawings
【AMENDED ARTICLE】 All the Drawings
【TYPE OF AMENDMENT】 Revision
【AMENDED MATTERS】